

REMARKS/ARGUMENTS

In the official communication of February 25, 2002, the Examiner objected to original claims 21–52 under 35 U.S.C. 103(a) as being unpatentable over Partridge et al., Whittaker et al., and Boisde et al. We submit that there is no motivation in any of these references for the combination suggested by the Examiner; and furthermore, even if the combination were motivated, it still would not fulfill the requirements of the present claims.

As stated by the Examiner in the Office Action, Partridge et al. shows an apparatus and method for measuring a gas in the atmosphere in which the wavelength of a beam of light is scanned across the absorption line of the gas of interest (see col. 4, lines 23–26). In contrast to the instant invention, Partridge et al. employs a broadband light source that uses an interference filter to modulate the wavelength of the radiation beam to obtain a specific wavelength band. The interference filter may be rotated to alter the transmitted wavelength to scan across an absorption band. This is a very inefficient approach in comparison to a tunable diode laser because it only transmits a small fraction of the radiation through the filter (see col. 4, lines 53–55). In contrast, the instant invention employs a tunable diode laser wherein all of the radiation is transmitted from the source.

Moreover, the apparatus in Partridge et al. will not work for very narrow wavelength bands that require small degrees of rotation of the interference filter (i.e. less than 10°). In these cases, the transmitted radiation that passes through the interference filter is too small to provide a proper reading. As a result, the transmission profile becomes extremely degraded and is insufficient for scanning purposes. In contrast, the instant invention uses a tunable diode laser that can be accurately controlled as a function of frequency to scan across very narrow wavelength bands. Accordingly, the apparatus of the instant invention is capable of a wider range of operation and does not have the limitations inherent in the apparatus taught in Partridge et al. Accordingly, it is respectfully submitted that Partridge et al. relates to a completely different apparatus and method and should not be considered relevant in determining the patentability of the instant invention—it would not have taught anything relevant to the tuneable diode laser technology employed in the instant invention.

As stated by the Examiner in the Office Action, Whittaker et al. shows that the wavelength scanning as described in Partridge et al. can be obtained by modulating the wavelength of a tunable laser. Whittaker et al. discloses a mid-IR system that uses a second carefully chosen modulation to minimize the effects of interference fringes on the measurement of a gas species in the optical path. Whittaker et al. shows a laboratory based instrument setup where the modulated mid-IR laser beam is directed immediately through a low-pressure sample cell and onto a detector. The purpose of this setup is to demonstrate that the particular triangular modulation applied to the laser reduces etalons. In fact no value for the concentration of carbonyl sulfide in the cell is provided, and this can only be inferred from Figure 7 of the patent which is a very slow scan (16 seconds) of the laser central wavelength across the absorption feature.

Accordingly, it is respectfully submitted that Whittaker et al. relates to a completely different apparatus and method and should not be considered relevant in determining the patentability of the instant invention—it would not have taught anything relevant to the development of the remote sensing system in the instant invention. The fringe-canceling scheme of Whittaker et al. would be unlikely to work in a less controlled environment, such as a stack environment (the fringes would tend to move around with changes in temperature, alignment, etc.), that the present invention is intended to be used in.

As provided by the Examiner in the Office Action, Partridge et al. shows using an optical fiber (34, shown in Figure 5) to direct light to and from a measurement station, and states that this allows the light source and detector to be removed from the measuring area (see col. 8, lines 16-22). As provided by the Examiner in the Office Action, Boisde et al. shows using optical fibers to carry light to and from the measuring stations that a single light source and detector can be used to monitor multiple test areas by multi-plexing the light to 'look at' different measuring stations at different times. The Examiner concludes that it would have been obvious to so multiplex measurements as shown in Figure 5 of Partridge to monitor more than one remote area without having to duplicate the entire measuring apparatus.

It is respectfully submitted that there is no specific teaching in either reference to combine a single optical fiber with a multi-plexing arrangement. For example, if one were to follow the teachings of the prior art, a person skilled in the art might modify the apparatus and

method of, Partridge et al. by adding in the multi-plexing arrangement of Boisde et al., including the multiple fiber optic cables.

Overall, as acknowledged by the Examiner, none of the references cited by the Examiner disclose the exact apparatus or method as claimed herein. The applicant respectfully submits that there is neither teaching nor motivation in the references as to how a person skilled in the art would re-combine the references to obtain the apparatus or method of the instant invention. A person skilled in the art would have to very selectively cut and paste from the prior art references cited by the Examiner to obtain all of the elements of the apparatus and method claimed herein. Lacking any motivation to combine the references in such a manner, the applicant respectfully submits that the claims are allowable over the art.

Applicant submits that this is a complete response to the outstanding Examiner's communication and that this application is in condition for allowance. Such action is respectfully solicited. Should the Examiner have anything further to discuss to bring this application into condition for allowance, applicant invites the Examiner to contact the undersigned by telephone at (416) 957-1697.

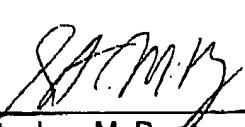
Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claims 21, 38, and 45 have been amended as follows.

21. (Amended) An apparatus for monitoring selected trace constituents in exhaust gases ~~in the atmosphere~~, the apparatus comprising:

- (a) a laser tuneable over a range of frequencies for generating a laser beam;
- (b) control means to control the frequency of the laser to scan rapidly across an absorption range encompassing an absorption line of a selected trace constituent gas ~~of interest~~;
- (c) transmission means to transmit the laser beam through a region of the atmosphere exhaust gas;
- (d) detection means for detecting the laser beam after transmission through the region of the atmosphere exhaust gas; and
- (e) processing means for providing the concentration of the selected trace constituents by comparing the detected laser beam to the transmitted laser beam.

38. (Amended) An apparatus for the remote detection of selected trace constituents in flue gases ~~in the atmosphere~~, in use with an installation comprising at least one stack for discharging flue gases to the atmosphere and at least one building providing an enclosed area, the apparatus comprising:

- (a) a laser tuneable over a range of frequencies for generating a laser beam;
- (b) control means to control the frequency of the laser to rapidly scan across an absorption range encompassing an absorption line of a selected trace constituent gas ~~of interest~~;
- (c) transmission means to transmit the laser beam through the flue gas;
- (d) detection means for detecting the laser beam after transmission through the flue gas;
- (e) processing means for providing the concentration of the selected trace constituents by comparing the detected laser beam to the transmitted laser beam.

(f) a multiplexer means providing a connection between the laser and the transmission means and between the detection means and the processing means; and

(g) an optical fiber connection means providing a connection between a laser and the optical transmission means and between the detection means and the processing means;

wherein the transmission means and the detection means are mounted to one stack adjacent the top thereof, whereby a laser beam is transmitted through the flue gases discharged in the stack, and wherein the laser, the detection means and the multiplexer means are located in the enclosed area of the building, whereby the laser, the detection means and the multiplexer means are protected by the building, the pairs of optical transmission means and detection means are remote from the laser and the detection means and are connected thereto by the optical fiber connection means, and the multiplexer means can selectively connect the laser to any one pair of the optical transmission means and the detector means.

45. (New) A method of monitoring selected trace constituents in exhaust gases in the atmosphere, the method comprising:

(a) transmitting a laser beam tuneable over a range of frequencies through the exhaust gas region of the atmosphere to be monitored;

(b) controlling the frequency of the laser to scan rapidly across an absorption range encompassing an absorption line of a selected trace constituent gas of interest;

(c) detecting the transmitted laser beam after transmission of the beam through the exhaust gas region of the atmosphere; and

(e) determining the concentration of the selected trace constituents by comparing the detected laser beam to the transmitted laser beam.